



Total Maximum Daily Load Implementation Strategies

for

Fee Fee Creek (new)
St. Louis County

Pollutants of concern: Pathogens

Water Body Summary

Pollutant: Pathogens as indicated by *E. coli*

Name: Fee Fee Creek (new)

Location: St. Louis County near Maryland Heights

8-digit Hydrologic Unit Code (HUC) and Name:¹

HUC 10300200 – Lower Missouri Subbasin

12-digit Hydrologic Unit Code (HUC) and Name:¹

HUC 103002000703 – Creve Coeur Creek Subwatershed

Water Body Identification Number and Hydrologic Class:²

Water body identification 1704 – Class P

Designated uses:³

Whole body contact recreation category B

Secondary contact recreation

Warm water habitat (aquatic life)

Human health protection

Livestock and wildlife protection

Irrigation

Impaired Use:

Whole body contact recreation category B

Secondary contact recreation

Pollutant Identified on the 2018 303(d) List:

Escherichia coli (*E. coli*) bacteria

Length and Locations of Impaired Segment:

WBID 1704; 1.5 mi (2.4 km), from mouth to Sur 992, Township 46N, Range 5E



¹ The U.S. Geological Survey delineates watersheds using a nationwide system based on surface hydrologic features. This system divides the country into 2,270 8-digit hydrologic units (USGS 2013; NRCS 2013). A hydrologic unit is a drainage area delineated to nest in a multilevel, hierarchical drainage system. A hydrologic unit code is the numerical identifier of a specific hydrologic unit consisting of a 2-digit sequence for each specific level within the delineation hierarchy (FGDC 2003).

² For hydrologic classes see 10 CSR 20-7.031(1)(F). Class P streams maintain flow even in drought conditions.

³ For designated uses see 10 CSR 20-7.031(1)(C) and 10 CSR 20-7.031 Table H. Presumed uses are assigned per 10 CSR 20-7.031(2)(A) and (B) and are reflected in the Missouri Use Designation Dataset described at 10 CSR 20-7.031(2)(E).

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Fee Fee Creek (new), February 2020

1. Introduction

A total maximum daily load (TMDL) identifies water quality problems, possible causes of those problems, and provides targets for restoration. Real water quality improvements, however, are often dependent upon actions and support from local communities and landowners residing within the watershed. This document is a supplemental planning document to aid in the implementation of activities in the Fee Fee Creek (new) watershed that will address the goals established in the Fee Fee Creek (new) *E. coli* TMDL. Although separate, this implementation plan should be considered a companion to the TMDL. The purpose of this implementation plan is to serve as a general guide to permit writers, nonpoint source program coordinators, and other Missouri Department of Natural Resources staff, as well as Soil and Water Conservation districts, local governments, permitted entities, regional planning commissions, watershed managers, and citizen groups for achieving the wasteload and load allocations established in the TMDL. The *E. coli* TMDL report for Fee Fee Creek (new) is available on the Department's website at <https://dnr.mo.gov/env/wpp/tmdl/1704-fee-fee-creek-record.htm>. Questions regarding the TMDL may be sent via email to tmdl@dnr.mo.gov or by calling the Department's Watershed Protection Section at 573-751-5723.

The Department recognizes that technical guidance and support are critical to achieving the goals of the TMDL. While the TMDL establishes the maximum bacteria loading that Fee Fee Creek (new) can assimilate and still meet water quality standards, this implementation plan provides additional information regarding best management practices, potential participants in the watershed, and calculations of pollutant reductions in order to guide implementation activities that will eventually restore attainment of water quality standards. This plan is not intended to prescribe or prohibit any specific practices or technologies to reduce bacteria loading in the Fee Fee Creek (new) watershed. Nor is it intended to serve as the sole means of remediation and restoration of impaired water bodies in the watershed. Any existing or planned Section 319 nine element watershed-based plans that address regions or subwatersheds within the Fee Fee Creek (new) watershed should be updated to incorporate the goals and strategies outlined in this plan. Any such plans or other known management practices already in place that will aid in meeting the goals established in the TMDL are referenced in this plan in order to facilitate those efforts without duplicating the work.

Because the TMDL addresses bacteria loading from all potential sources in the watershed, this implementation plan provides guidance for meeting the established loading targets assigned to both point and nonpoint sources.⁴ Point sources of pollution are regulated through the federal Clean Water Act. Any reductions in bacteria loading from these sources will primarily be completed through the Missouri State Operating Permit program along with any other enforcement or legal actions administered for compliance with this law (see section 6.1). Nonpoint sources of pollution are not regulated through permits and any reductions from these sources will rely on the voluntary implementation of best management practices (BMP), in the watershed (see section 6.2).

The location of the impaired water body segment addressed by the Fee Fee Creek (new) *E. coli* TMDL is presented on the next page in Figure 1.

⁴ Point and nonpoint sources are defined and discussed in sections 5.1 and 5.2 of the Fee Fee Creek (new) *E. coli* TMDL.

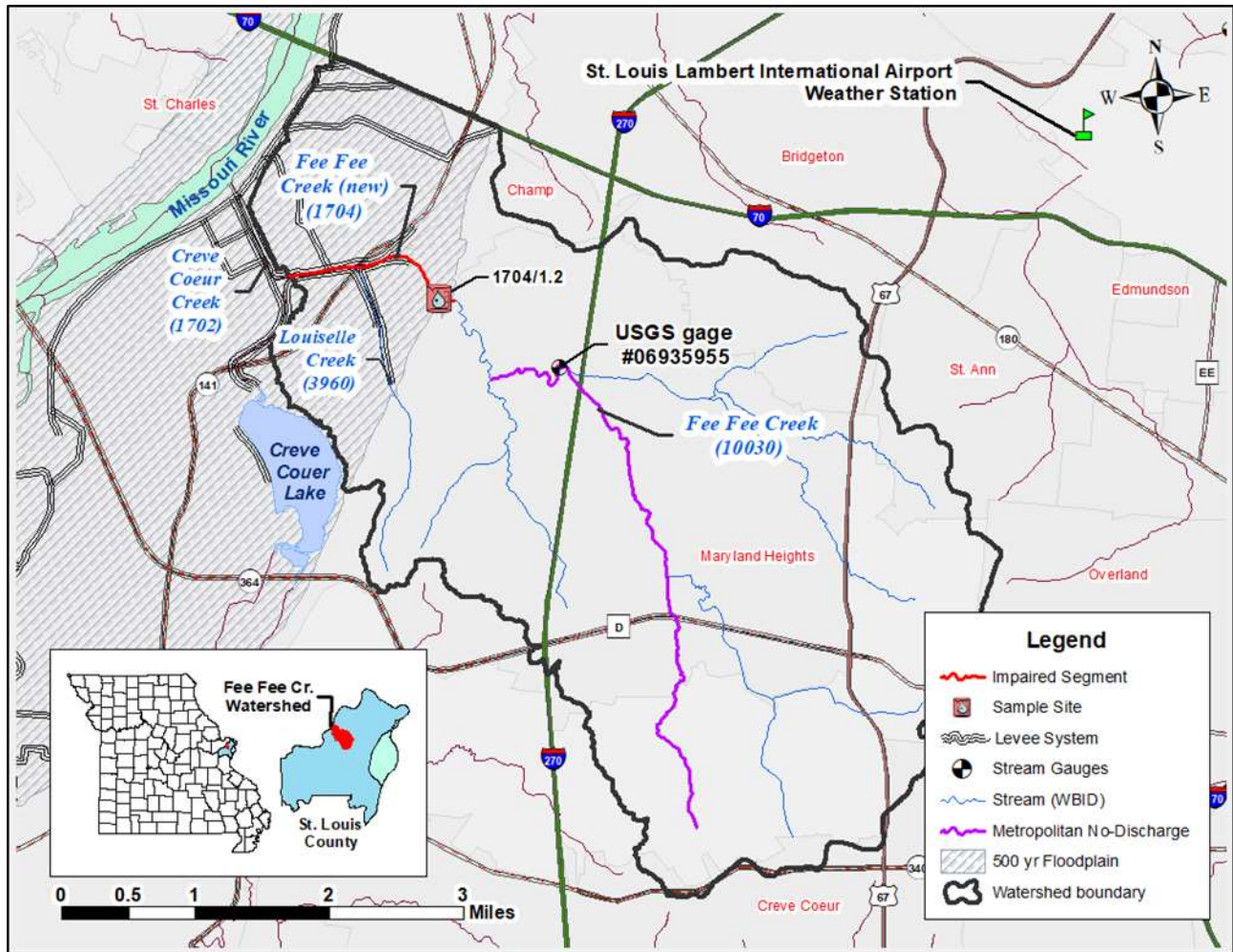


Figure 1. Map of the Fee Fee Creek (new) watershed

2. Targeted Participants and Potential Roles in Implementation

TMDL implementation is carried out in part by the Department through the Missouri State Operating Permit program for point sources and for nonpoint sources through projects and cost-share practices funded in part by grants or subgrants from the Department's Section 319 Nonpoint Source Implementation Program and the Soil and Water Conservation Program. Additional implementation can be completed through actions taken by local governments, citizen groups, and others with an interest in improving water quality in their communities. Successfully meeting the goals of the TMDL will require participation and cooperation from the various parties within the watershed with roles ranging from technical support to actual on-the-ground implementation of BMPs. Groups and agencies that may potentially be involved in the TMDL implementation process are identified below along with descriptions of their possible roles. This list is not exhaustive and is not intended to compel participation from any organization; nor is it meant to exclude those who are not listed, but may be interested in participating.

- Department of Natural Resources
 - Administer statutory authorities granted by Missouri clean water law
 - Ensure permits issued in the watershed are consistent with the assumptions and requirements of TMDL wasteload allocations per federal regulations
 - Provide compliance assistance, inspections, and enforcement actions to regulated entities as appropriate
 - Provide technical support to watershed groups as appropriate
 - Serve as a potential source of financial assistance for watershed plan development or BMP implementation through Section 319, 604(b) grants, or Soil and Water Program cost-share practices
 - Serve as a potential source of financial assistance for infrastructure improvements through low-interest State Revolving Fund loans
 - Assess compliance with water quality standards on a biennial basis in accordance with Sections 303(d) and 305(b) of the federal Clean Water Act
 - Coordination of watershed planning efforts and promotion of stakeholder involvement
- Metropolitan St. Louis Sewer District
 - Implement activities as described and scheduled in consent decree⁵
 - Reduce sanitary sewer overflows as described and scheduled in consent decree
 - Implement MS4 permit terms and conditions pertaining to discharges to TMDL waters
 - Continued implementation of the six minimum control measures to effectively reduce pollutants to the maximum extent practicable (MEP) to the MS4
- MS4 co-permittees located in the Fee Fee Creek (new) watershed
 - Implement MS4 permit terms and conditions pertaining to discharges to TMDL waters
 - Continued implementation of the six minimum control measures to effectively reduce pollutants to the MEP to the MS4
- Missouri Department of Transportation
 - Implement MS4 (TS4) permit terms and conditions pertaining to discharges to TMDL waters
 - Continued implementation of the six minimum control measures to effectively reduce pollutants to the MEP to the MS4 (TS4)

⁵ A consent decree was established as part of the *United States of America and the State of Missouri, and Missouri Coalition for the Environment Foundation v. Metropolitan St. Louis Sewer District*, No. 4:07-CV-1120. The consent decree and its appendices are available online at epa.gov/region07/enforcement_compliance/MSD_consent_decree_cwa.htm.

- County Soil and Water Conservation District
 - Provide financial incentives to urban agricultural producers for the implementation of conservation practices that help prevent soil erosion
 - Provide technical assistance with design, implementation and maintenance of conservation practices
- University of Missouri Extension
 - Technical assistance with nonpoint source and watershed management issues
 - Assistance in organizing locally led watershed groups
- Missouri Department of Conservation
 - Technical assistance with stream and watershed management issues
 - Promote maintenance and reestablishment of functional riparian corridors
- Missouri Department of Health and Senior Services
 - Technical assistance and regulatory authority regarding onsite wastewater treatment systems
- County health department
 - Technical assistance and regulatory authority regarding local ordinances
- Locally led watershed groups
 - May apply for Section 319 subgrants
 - Help identify critical areas at a local level
 - Voluntary implementation of BMPs
 - Public education and outreach
- Stream Team volunteers⁶
 - Volunteer Water Quality Monitoring program - *E. coli* monitoring may be conducted at the Cooperative Stream Investigation level⁷
 - Stewardship (e.g., litter pick up and storm drain stenciling)
 - Advocacy
 - Education
- General public within the Fee Fee Creek watershed
 - Voluntary lifestyle changes (e.g., pet waste cleanup, septic system maintenance, water conservation, erosion control practices, etc.)
 - Voluntary implementation of BMPs on private lands, residences, and businesses

3. Why is a TMDL needed for Fee Fee Creek (new)?

Section 303(d) of the federal Clean Water Act and Chapter 40 of the Code of Federal Regulations Part 130 requires states to develop TMDLs for waters not meeting applicable water quality standards. Missouri's Water Quality Standards consist of three major components: designated uses, water quality criteria to protect those uses, and an antidegradation policy. Descriptions of each of these components can be found in Section 3 of the TMDL. Fee Fee Creek (new) is not attaining designated recreational uses due to exceedances of Missouri's numeric criteria for *E. coli* bacteria. High counts of *E. coli* are an indication of fecal contamination and an increased risk of pathogen induced illness. A summary of the available

⁶ The Missouri Stream Team Program is a partnership between the Department of Natural Resources, the Department of Conservation, the Conservation Federation of Missouri, and the citizens of Missouri. The Stream Team Program provides an opportunity for all citizens to get involved in river conservation. Additional information regarding the Stream Team program is available online at mostreamteam.org.

⁷ More information regarding the Volunteer Water Quality Monitoring (VWQM) program is available online at dnr.mo.gov/env/wpp/VWQM.htm. Cooperative Stream Investigation (CSI) level monitoring uses EPA approved and accepted analytical methods as well as standard analytical methods developed for the VWQM program. More information regarding the CSI level of training is available on the department's website at dnr.mo.gov/env/esp/csi.htm.

E. coli data for Fee Fee Creek (new) is presented in Table 4 of the TMDL report. The Department determines a water to be impaired by pathogens if the *E. coli* criteria are exceeded in any of the last three years for which there is a minimum of five samples taken during the recreational season. Missouri’s recreational season is defined in rule as being from April 1 to October 31. Table 1 below presents the recreational uses assigned to Fee Fee Creek (new).

Table 1. Designated recreational uses of Fee Fee Creek (new)

Stream Name	WBID	Designated Recreational Uses*
Fee Fee Creek	1704	WBC-B, SCR

* WBC-B = whole body contact recreation category B

SCR = secondary contact recreation

Designated uses for water bodies in Missouri are identified in the state’s Water Quality Standards at 10 CSR 20-7.031. The federal Clean Water Act at Section 101(a)(2) requires that wherever attainable, waters be designated with uses that provide for recreation in and on the water. Missouri’s Water Quality Standards include three recreational uses. These uses include whole body contact recreation category A, whole body contact recreation category B, and secondary contact recreation. Whole body contact recreation includes activities in which there is direct human contact with surface water that results in complete body submergence, thereby allowing accidental ingestion of the water as well as direct contact to sensitive body organs, such as the eyes, ears, and nose. Category A waters include water bodies that have been established as public swimming areas and waters with documented existing whole body contact recreational uses by the public (10 CSR 20-7.031(1)(C)2.A.(I)). Category B applies to waters designated for whole body contact recreation, but are not contained within category A (10 CSR 20-7.031(1)(C)2.A.(II)). Secondary contact recreation includes activities in which there is limited, incidental or accidental contact with the water and the probability of ingesting appreciable quantities of water is minimal. Such activities include boating, fishing, and wading (10 CSR 20-7.031(1)(C)2.B.).

4. Review of Sources of Bacteria Loading in the Fee Fee Creek (new) Watershed

Section 5 of the Fee Fee Creek (new) *E. coli* TMDL contains a comprehensive inventory and assessment of all known and suspected sources of bacteria loading in these watersheds. The bacteria sources identified in the TMDL are based on issued permits and a general knowledge of watershed conditions. For some sources, specific loading contributions remain unknown. Groups interested in implementing BMPs in the watershed may want to consider employing microbial source tracking techniques to better identify the primary sources of *E. coli* in their area (i.e., humans, poultry, equine, cattle, domestic pets, or wildlife). However, such techniques can be cost-prohibitive and may be unnecessary if localized land use activities are already well known. More information regarding microbial source tracking techniques is available online from the U.S. Geological Survey at <http://water.usgs.gov/owq/microbial.html>. See Table 2 for a list of the potential sources of *E. coli* identified in the TMDL report.

Table 2. Potential sources of *E. coli* loading to Fee Fee Creek (new)

Point Sources	Non-point Sources
<ul style="list-style-type: none"> • Municipal and domestic wastewater treatment facilities <ul style="list-style-type: none"> o Inadequate treatment or disinfection o Sanitary sewer overflows • Concentrated Animal Feeding Operations (CAFOs) • Illicit straight pipe dischargers 	<ul style="list-style-type: none"> • Onsite wastewater treatment systems • Urban stormwater runoff • Agricultural stormwater runoff • Natural background conditions (i.e., wildlife)

5. Existing Loads and Needed Reductions

A water quality impairment occurs when existing pollutant loading to a water body exceeds that water body's assimilative capacity for that pollutant. In order to restore an impaired water body to conditions that meet water quality standards, current pollutant loading must be reduced. Reducing pollutant loading to the impaired streams from existing levels to levels equal to or less than the loading capacities calculated in the TMDL report will result in attainment of water quality standards. In order to estimate the amount of reduction that is needed, an estimate of existing loading must first be made.

Individually observed bacteria measurements collected during the recreational seasons of 2014 through 2018 were plotted on the TMDL load duration curve, as shown in Figure 7 in the TMDL report. Since the bacteria criterion for the protection of whole body contact recreation category B is expressed in Missouri's Water Quality Standards as a geometric mean, the loads calculated from individually observed measurements cannot be compared directly to the TMDL curve to estimate overall existing loading or needed reduction. Therefore, geometric means of the observed data within each specific flow range were calculated to make a comparison. The calculated geometric means presented in Table 3 of this plan represents estimates of existing loading to Fee Fee Creek (new). These estimates represent loading from both point and nonpoint sources in the watershed, as the available data is inadequate for estimating existing loading from specific sources. An estimation of the amount of load reduction needed at each flow condition to achieve the TMDL target can be estimated by calculating the difference of the estimated existing load from the loading capacity. Implementation actions that reduce loading during the flow conditions where the geometric mean of the observed data exceed the loading capacity will provide the greatest water quality benefit, but because the recreational use criterion is a geometric mean, it may also be possible to meet water quality standards by reducing the frequency and magnitude of individual excursions above the loading capacity at any flow.

Additional water quality monitoring sites and sampling may help determine loading from a specific source or area in the watershed and help estimate the amount of reduction needed from that particular source. Such sampling may also be useful in determining critical areas where the greatest load reductions are needed and to determine how effective treatment technologies or BMPs are in achieving those reductions. Groups are encouraged to consult with the Department's Water Quality Assessment and Monitoring Unit, available at 573-526-5297, for developing a monitoring component to any localized implementation or water quality improvement plans. Other department monitoring goals are specified within section 12 of the TMDL report.

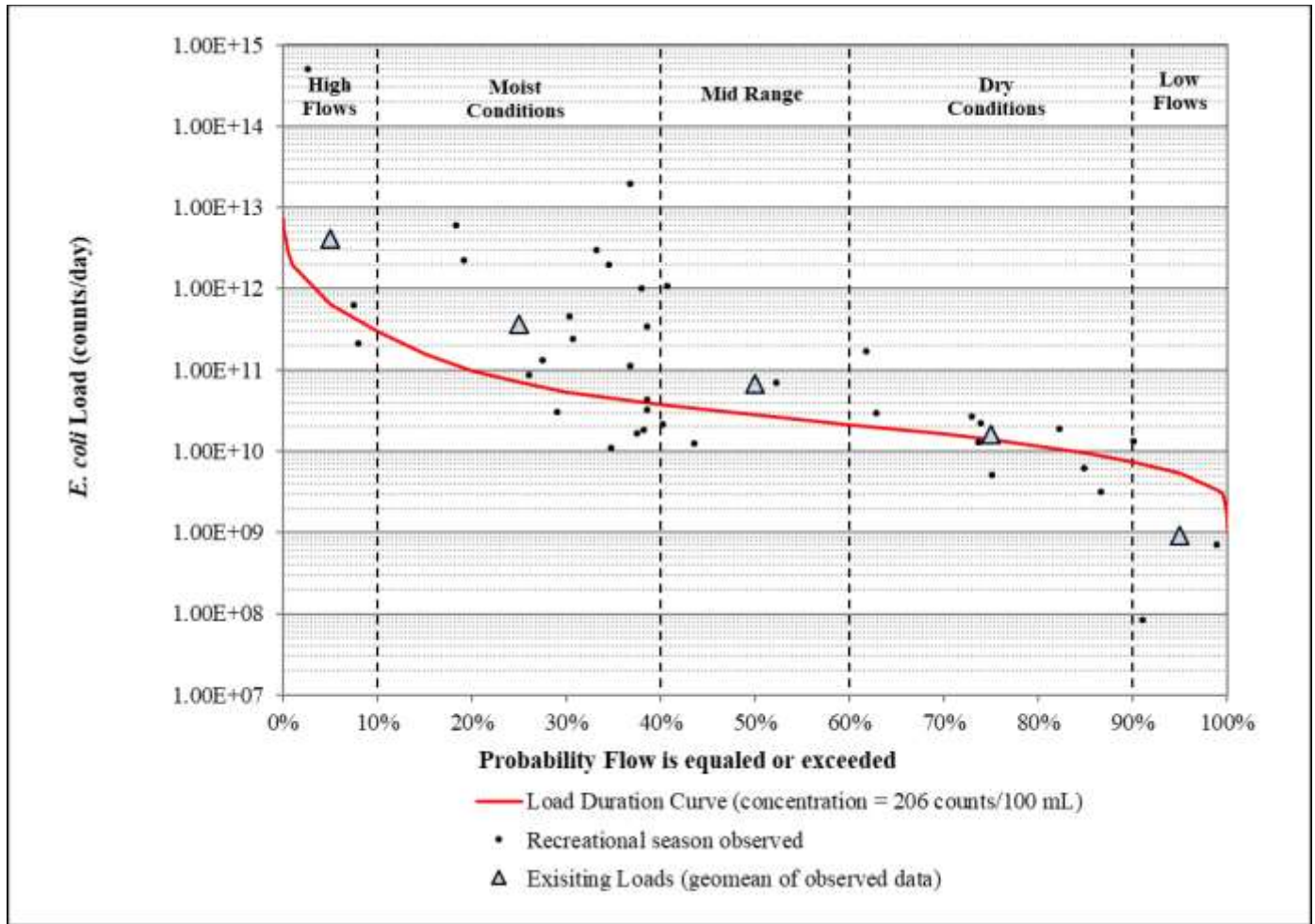


Figure 2. Fee Fee Creek (new) load duration curve with recreational season geomean values of observed data.

Table 3. Estimated load reductions for Fee Fee Creek, WBID 1704⁸

Percent of time flow exceeded	Flow m ³ /s (ft ³ /s)	TMDL (counts/day)	MS4 WLA (counts/day)	LA (counts/day)	Reduction Needed (percent)
95	0.03 (1.05)	5.29E+09	4.76E+09	5.29E+08	0.00%
75	0.08 (2.78)	1.40E+10	1.26E+10	1.40E+09	13.00%
50	0.16 (5.61)	2.83E+10	2.55E+10	2.83E+09	58.02%
25	0.39 (13.90)	7.00E+10	6.30E+10	7.00E+09	80.87%
10	3.64 (128.42)	6.47E+11	5.82E+11	6.47E+10	84.24%

6. Implementation of the TMDL

TMDLs are not self-implementing and are not in and of themselves regulatory documents. Despite this, TMDLs provide a foundation for establishing water quality goals and determining appropriate actions and controls necessary for pollutant reductions. Progress towards meeting water quality standards in Fee Fee (new) Creek is expected to be long-term, and initial TMDL

⁸ Estimates of existing loads and needed reduction are based on data available at the time of TMDL development. These estimates may be refined after the collection of additional data. The amount of overall loading and needed reductions are expected to decrease over time as implementation actions occur and progress is made to attain water quality standards.

implementation will primarily be a continuation of already existing and planned activities.⁹ Except in cases where activities and schedules are required by legally binding requirements, such as consent decrees or established permit conditions, an adaptive implementation approach that makes progress toward achieving water quality goals while using new data and information to reduce uncertainty and adjust implementation activities should be used. The Department will routinely examine available water quality data collected by other local, state and federal entities as part of its biennial assessment of water quality for federal Clean Water Act 305(b) and 303(d) reporting.

6.1 Point Source Implementation

Federal regulations at 40 CFR §122.44(d)(1)(vii)(B) require that permit conditions be consistent with the assumptions and requirements of TMDL wasteload allocations. How these conditions are expressed can vary depending upon the nature of the discharge. Although TMDLs are required to be written for daily time increments, permit effluent limits may be written in a form that derives from, and complies with, applicable water quality standards that use any time measure [40 CFR 122.44(d)(1)(vii)(A) and EPA 2006]. The Department's permit writers have discretion for how TMDL wasteload allocations are considered in the permit and for determining appropriate schedules for implementation. Permit writers should consult available permit writing handbooks and technical support documents to determine appropriate limits.¹⁰ Although wasteload allocations are often specified for individual facilities, in some cases it may be appropriate for pollutant loadings to be shifted between the individual wasteload allocations during NPDES permitting as long as the sum of the wasteload allocations remains unchanged and is not exceeded (EPA 2012). In no cases does a TMDL wasteload allocation allow for permit limits that exceed water quality standards. If water quality standard revisions result in criteria more stringent than an established TMDL wasteload allocation, then the more stringent criteria should be used in deriving the permit limits.¹¹ Information regarding the Department's permitting process is available online at dnr.mo.gov/env/wpp/permits/index.html or by calling the Department's Operating Permit Section at 573-522-4502. Point sources identified as potential contributors of bacteria in the Fee Fee Creek (new) watershed include discharges from MS4s, sanitary sewer overflows, and illegal straight pipe discharges.

6.1.1 Municipal Separate Storm Sewer Systems (MS4s) discharges

Background: Two MS4 permits regulate urban stormwater discharges in the Fee Fee Creek (new) watershed. The Missouri Department of Transportation holds one of these MS4 (TS4) permits and the Metropolitan St. Louis Sewer District along with its various co-permittees holds the other.

Objective: The Fee Fee Creek (new) *E. coli* TMDL uses an aggregated wasteload allocation to assign allowable pollutant loading for MS4 discharges. All MS4s must reduce pollutant loading to the maximum extent practicable, but for implementation planning and evaluation purposes,

⁹ Some implementation activities predate the writing of this implementation plan. The Metropolitan St. Louis Sewer District's consent decree obligations began in 2012.

¹⁰ The Department maintains a Water Pollution Control Permit Manual to provide guidance to permit writing staff and is available online at dnr.mo.gov/env/wpp/permits/manual/. Additionally the EPA maintains a National Pollutant Discharge Elimination System (NPDES) Permit Writers' Manual online at www.epa.gov/npdes/npdes-permit-writers-manual and other technical support documents for water quality-based permitting at cfpub.epa.gov/npdes/docs.cfm?program_id=2&view=allprog&sort=name.

¹¹ Federal regulations at 40 CFR 131.21, also known as the "Alaska Rule," require water quality standards to be approved by EPA before they can be used for federal Clean Water Act purposes (i.e., water quality-based effluent limitations or TMDLs).

individual wasteload allocations may be estimated based on the proportion of each regulated entity's MS4 area within the watershed. Table 4 presents area information for making such estimates and is provided for informational purposes only to assist MS4 permittees in planning decisions. This information is not intended for permitting purposes and only represents areas contained within the U.S. Census Bureau's defined urban area (approximately 90 percent of the entire watershed area). Pollutant loading from areas not contained within the urban area were assigned to the nonpoint source load allocation. However, should areas considered in the load allocation be included in future designations of the Census Bureau's urban area or otherwise contribute to a regulated MS4, then that portion of the load allocation may be applied to the wasteload allocation without reopening the TMDL.

Strategy 1: MS4 permits require implementation of a comprehensive stormwater management program to minimize negative impacts to water quality and the aquatic ecosystem, to monitor and eliminate illicit discharges, and to provide long-term water quality protection. As required by the MS4 permits, a stormwater management plan must address six minimum control measures. These measures include public education and outreach, public involvement and participation, illicit discharge detection and elimination, construction site runoff control, post-construction runoff control, and pollution prevention and general housekeeping for municipal operations. Continued implementation of these six minimum control measures is expected to aid in overall bacteria reductions as stormwater reductions are achieved; however, additional BMPs may be necessary to achieve the stated TMDL wasteload allocations specific to *E. coli*. Such additional BMPs may be those required by state operating permits or those specified in the Metropolitan St. Louis Sewer District's consent decree. It is likely that BMPs implemented to reduce stormwater inputs into the separate sanitary sewer system that result in reductions in sanitary sewer overflows will help to reduce bacteria loading from the MS4s. Additional information regarding MS4 permit requirements can be found in Missouri's Stormwater Clearinghouse online at dnr.mo.gov/env/wpp/stormwater/sw-local-gov-programs.htm.

Table 4. Proportions MS4 area for MS4 permittees in the Fee Fee Creek (new) watershed*

MS4 Permittee or co-permittee	MS4 Area mi ²	MS4 area %
Bridgeton	1.17	7.0%
Creve Coeur	0.31	1.9%
Maryland Heights	9.77	58.4%
Overland	0.06	0.4%
St. Ann	0.42	2.5%
St. Louis County	4.31	25.8%
MoDOT	0.69	4.1%
TOTAL:	16.73	

*Note the area described here as being MS4 area corresponds with the U.S. Census Bureau's defined urban area and accounts for 90 percent of the total watershed area.

The Metropolitan St. Louis Sewer District has posted the MS4 stormwater management plan on their website at stlmsd.com. Summaries of BMPs for reducing urban stormwater and pollutants in stormwater are also presented on their website. Some examples of structural BMPs mentioned include rain gardens, rain barrels, and detention basins to capture stormwater, as well as overall reductions of impervious surfaces. A map viewer of MSD post-construction stormwater runoff

BMP activities is available at

<https://stlmsd.maps.arcgis.com/home/item.html?id=c05a7d50dc9f4211936f6543113b20b4#overview>.

Nonstructural BMPs, such as picking up pet wastes and maintaining longer lawns, are also mentioned. The purpose of these practices is to reduce the volume of stormwater runoff from the MS4 area that directly enters streams and, consequently, reduce the potential for erosion resulting from runoff conditions. This reduction in overall runoff and erosion is expected to reduce bacteria loading during storm events. The Missouri Department of Transportation also makes their MS4 stormwater management plan available online at modot.org/stormwater. In addition to stormwater runoff reductions, the Department of Transportation plan provides information regarding BMPs associated with erosion control and sediment containment, which can reduce the likelihood of bacteria contaminated sediments from entering a stream via runoff. Additionally, the plan includes goals of restoring and revegetating riparian areas that the agency's activities may have disturbed. Although these activities do not target *E. coli* directly, reductions in runoff and sediment entering Fee Fee Creek (new) is expected to reduce bacteria loading.

Strategy 2: General reductions in stormwater are expected to aid in overall pollutant reductions, but BMPs specifically designed to address the pollutant of concern should be considered. Although few BMPs are specifically designed to address bacteria directly, the International Stormwater BMP Database, available online at bmpdatabase.org, provides information about various BMP efficiencies for reducing specific pollutants including bacteria. BMPs found to show a statistically significant decrease of bacteria include bioretention BMPs, retention ponds, and wetland basins (Table 5).

Table 5. Influent/Effluent Summary for BMPs with a statistically significant decrease in *E. coli*

BMP Type	# of Studies		25 th Percentile (count/100mL)		Median (count/100mL)		75 th Percentile (count/100mL)	
	In	Out	In	Out	In	Out	In	Out
Bioretention	4	4	44	6	290	101	2,400	2,400
Retention Ponds	4	4	582	10	2,063	100	5,500	697
Wetland Basin	5	5	383	88	1,369	637	7,169	2,376
Retention Pond + Wetland Basin	9	9	403	36	1,713	311	6,100	1,300

(Source: bmpdatabase.org 2014)

6.1.2 Sanitary Sewer Overflows

Background: Accidental and constructed sanitary sewer overflows were identified as potential point source contributors of bacteria to Fee Fee Creek (new). The federal Clean Water Act does not authorize discharges from sanitary sewer overflows.

Objective: Occurrences of accidental discharges should be reduced as much as possible and should be rare in occurrence. Constructed overflows are to be eliminated altogether. The TMDL does not allocate any portion of the loading capacity to sanitary sewer overflows and assigns a wasteload allocation of zero to these sources.

Strategy 1: The Metropolitan St. Louis Sewer District’s consent decree requires the elimination of all constructed sanitary sewer overflows in the Metropolitan St. Louis Sewer District’s service area. The complete elimination of constructed sanitary sewer overflows from the Fee Fee Creek (new) watershed will be consistent with the TMDL wasteload allocation of zero for these discharges. This represents a 100 percent reduction of bacteria loading from these sources. According to Metropolitan St. Louis Sewer District’s 2018 annual status report the last two sanitary sewer overflow structures will be scheduled to be eliminated no later than 2023.

Strategy 2: Sanitary sewer overflows caused by malfunctions or stormwater inflows could occur in any area where a sanitary sewer system is present. Facilities with sanitary sewer overflows must implement, as a condition of their operating permit, a Capacity, Management, Operation and Maintenance Plan, which is more frequently referred to as a CMOM. The EPA provides CMOM guidance at www3.epa.gov/npdes/pubs/cmom_guide_for_collection_systems.pdf. Common implementation activities for reducing sanitary sewer overflows include pipe cleaning to reduce blockages; pipe lining or replacement to reduce inflow and infiltration of outside water; public education to reducing the input of sewer clogging fats, oils and grease; and, in some cases, increases to the sewer system’s hydraulic capacity are made by enlarging pipes or by constructing storage tanks.

The Metropolitan St. Louis Sewer District’s consent decree includes the goal to eliminate these types of overflows and requires various repair and maintenance strategies to reduce occurrences of sanitary sewer overflows. Examples of such strategies mentioned in the consent decree include sewer-pipe lining and replacement, development of an operations and maintenance program, and continued implementation of a fats, oils, and grease program. These consent decree actions to reduce sanitary sewer overflows are consistent with the actions necessary for TMDL implementation and are expected to result in reductions of bacteria loading. It is estimated that

over its entire service area, controls already implemented by the Metropolitan St. Louis Sewer District, as well as those completed as part of its consent decree obligations, will reduce overflows into nearby streams by almost 13 billion gallons per year (EPA 2015).

6.1.3 Illicit (Illegal) Straight Pipe Dischargers

Background: These types of sewage discharges bypass treatment systems, such as a septic tank or a sanitary sewer, and instead discharge directly to a stream or an adjacent land area. Straight-pipe discharges are illegal and are not permitted under the Clean Water Act.

Objective: Due to the illegal nature of these types of discharges, straight-pipe discharges are not assigned a portion of the overall loading capacity. The complete elimination of these sources is consistent with the TMDL wasteload allocation of zero.

Strategy: The detection and elimination of illicit discharges is a required permit condition for MS4s. Therefore, implementation efforts to reduce loading from these sources in the Fee Fee Creek (new) watershed will be completed as part of the required six minimum control measures.

6.2 Nonpoint Source Implementation

The Department does not regulate nonpoint sources through permits. Nonpoint source loading is reduced using voluntary BMPs that can be implemented to address and improve land use practices that may be contributing bacteria to the impaired water bodies. Nonpoint source load reductions can be achieved from individual actions and BMP implementation from any place throughout the watershed, but may be more substantial and effective in restoring water quality when targeted and organized by locally led watershed groups or local governments who have developed a watershed-based management plan. The Department supports the development of nonpoint source watershed management based plans through competitive EPA funded subgrants. More information about the department's Section 319 Nonpoint Source Implementation Program is available online at dnr.mo.gov/env/wpp/nps/index.html or by calling 573-751-7428. The University of Missouri Extension also provides guidance and support for communities and citizens to develop organized watershed groups. Information regarding this program is available online at fsb.missouri.edu/extension/water-quality/.

Nonpoint sources primarily contribute bacteria loads at flows influenced by precipitation events through contaminated stormwater runoff and the erosion of bacteria contaminated sediments. For this reason, BMPs that reduce runoff and erosion will be the primary means of achieving load reductions from nonpoint sources to meet the target load allocation. However, failing onsite wastewater treatment systems and direct waste inputs from animals that are not excluded from waterways can contribute bacteria loads under dry conditions as well. Therefore, BMPs that reduce nonpoint source loading at lower flows may also help to attain water quality standards. Onsite wastewater treatment systems were identified as nonpoint sources in the Fee Fee Creek (new) watershed. Agricultural land make up a small percentage (5%) located in the lower portion of the Fee Fee Creek (new) watershed. The majority of the Fee Fee Creek (new) is levied, which will control stormwater inputs to the stream channel.

6.2.1 Onsite Wastewater Treatment Systems

Background: Failing onsite wastewater treatment systems may be sources of bacteria to nearby waterways during periods associated with either wet weather or dry weather flows depending upon the nature of the failure. Proper maintenance of onsite wastewater treatment systems,

including septic tanks, associated drain fields, and household lagoons is the primary BMP for limiting bacterial inputs from these sources.

Objective: By design, properly functioning onsite wastewater treatment systems should not be contributing significant bacteria loads to surface waters. For this reason, the TMDL assigns a load allocation of zero to these potential sources.

Strategy 1: Educate homeowners about proper onsite wastewater treatment system maintenance. This may be provided by local governments, local watershed groups, or by university extension offices. The EPA maintains various guidance documents and resources pertaining to onsite treatment systems online at water.epa.gov/infrastructure/septic/homeowner-resources.cfm including a “Homeowner’s Guide to Septic Systems.” Similarly, the East-West Gateway Council of Governments has developed a septic system maintenance guide for the Lower Meramec Watershed. Although not developed specifically for the region where Fee Fee Creek (new) is located, the guide, available online at ewgateway.org/pdf/library/wrc/septictankbrochure.pdf, does provide useful septic system information that is relevant throughout St. Louis County. For onsite wastewater treatment systems that are already failing, repairs or even replacement of the system are necessary.

Strategy 2: Local ordinances must be followed regarding permitting requirements pertaining to repairs, replacement, or the installation of new systems. Where feasible, enforcement of local ordinances requiring a sewer connection if a sewer system is within 200 feet of a home will also aid in reducing bacteria loading in the Fee Fee Creek (new) watershed.

Strategy 3: Considerations should also be given to reducing reliance on onsite systems in favor of centralized systems. Homeowners and local governments should explore the potential elimination of onsite systems and connection to existing sewer systems.

6.2.2 Urban Stormwater Runoff (Unregulated)

Background: Stormwater runoff from developed areas where impervious surfaces are common may contribute bacteria loads to surface waters.

Objective: Bacteria loading contributions from unregulated urban runoff are considered within the aggregated load allocation for nonpoint sources. Due to the small proportion of developed land in the watershed that contributes unregulated urban runoff, the TMDL does not anticipate the need to reduce bacteria loading from these areas to meet the specified loading targets. The primary sources of urban runoff in the watershed are regulated through MS4 permits. Nevertheless, strategies employed to maintain loading from unregulated sources to existing levels are encouraged. Riparian areas adjacent to urban development are especially susceptible to risks of degradation and should be specifically targeted for any BMP implementation to reduce erosional impacts and inputs from stormwater runoff.

Strategy 1: Reducing overall stormwater inputs into surface waters can help reduce bacteria loading. Various BMPs and green infrastructure options exist for increasing stormwater infiltration into the ground and reducing stormwater runoff. BMP selection will be dependent upon site location, community needs, and available funding. The EPA maintains resources for urban stormwater management and green infrastructure on its website at epa.gov/green-infrastructure/community-solutions-stormwater-management-guide-voluntary-long-term-

[planning](#). Likewise, the Department maintains the *Missouri Guide to Green Infrastructure* online at dnr.mo.gov/env/wpp/stormwater/mo-gi-guide.htm.

Strategy 2: Although general reductions in stormwater are expected to aid in reducing pollutant loading, BMPs designed to address the specific pollutant of concern should be considered. Although few urban BMPs are designed to directly target bacteria, the International Stormwater BMP Database, available online at bmpdatabase.org, provides information about various BMP efficiencies for reducing specific pollutants, including bacteria. BMPs that significantly decrease of bacteria loads include bioretention, retention ponds, and wetland basins (Table 6).

Table 6. Influent/Effluent Summary for BMPs with a statistically significant decrease in *E. coli*

BMP Type	# of Studies		25 th Percentile (counts/100mL)		Median (counts/100mL)		75 th Percentile (counts/100mL)	
	In	Out	In	Out	In	Out	In	Out
Bioretention	4	4	44	6	290	101	2,400	2,400
Retention Ponds	4	4	582	10	2,063	100	5,500	697
Wetland Basin	5	5	383	88	1,369	637	7,169	2,376
Retention Pond + Wetland Basin	9	9	403	36	1,713	311	6,100	1,300

(Source: bmpdatabase.org 2014)

Strategy 3: Non-structural BMPs can also aid in reducing bacteria loads from urban runoff. Proper collection and disposal of waste from domestic pets or backyard livestock (e.g., horses) reduces the potential for stormwater runoff to be exposed to *E. coli* contaminated substances. Education and outreach regarding this subject can result in behavioral changes that will aid in reducing

E. coli loading to surface waters. General steps that can be taken to reduce *E. coli* loading from domestic pets or backyard livestock include:

- Always pick up after animals and dispose of their waste properly;
- Encourage others to pick up after their pets;
- Prevent animal wastes from entering storm drains;
- Develop a storm drain marking program to increase awareness of where pet wastes and runoff go when not disposed of properly; and
- Avoid walking pets or horseback riding near streams and other waterways.

7. Costs of Implementation and Potential Funding Sources

TMDLs are written to meet applicable water quality standards per 40 CFR 130.7(c)(1), and this is done absent of considerations for cost and available treatment technologies. Despite this, facility upgrades and installations of BMPs do have costs associated with them that need to be considered before determining what practices and technologies to employ in order to meet the specified TMDL allocations and water quality targets. For point sources, TMDL implementation is partially a continuation of already permitted activities and some costs will be incurred as part of the normal operation and maintenance of those permitted systems. Additional costs will primarily result from activities and projects associated with meeting the obligations of the Metropolitan St. Louis Sewer District's consent decree. According to this consent decree, the district has already spent \$2.1 billion over the past 20 years in upgrading its sewer systems. The total cost of compliance with the consent decree, in 2011 dollars, is estimated to be \$4.7 billion

(MSD 2014). For nonpoint sources, there may be costs associated with the voluntary implementation of BMPs to reduce erosion and control stormwater runoff, as well as from the maintenance or repair of onsite wastewater treatment systems. These costs are variable and dependent upon the type, number, and complexity of the practice. Fortunately, a single BMP can often be utilized to address several pollutants, thereby providing additional benefits to compensate for overall costs. One online resource that provides estimates of BMP efficiencies as well as costs is the International Stormwater BMP Database at bmpdatabase.org.

Due to the costs associated with pollutant reduction and water quality improvement, a variety of grants and loan programs have been established to assist watershed stakeholders. The most commonly used sources of funding are low-interest loans through the State Revolving Fund, Section 319 subgrants, and cost-share practices through the state's Soil and Water Conservation Program.

Low-interest loans from the State Revolving Fund program through the Department's Water Protection Program Financial Assistance Center may be available. The State Revolving Fund provides low-interest loans to municipalities, counties, public sewer districts and political subdivisions for wastewater infrastructure projects. Projects may be new construction or the improvement or renovation of existing facilities. An onsite loan program to provide county or municipal governments with funding for addressing onsite wastewater treatment systems is currently under development. More information regarding the State Revolving Fund Program is available online from the Department's Water Protection Program Financial Assistance Center website at dnr.mo.gov/env/wpp/srf/index.html.

By amendment to the federal Clean Water Act in 1987, the Section 319 grant program was established to provide funding for efforts to reduce nonpoint source pollution. EPA provides 319 funding to the state, which in turn allocates a portion of the funding as subgrants to public and non-profit organizations to address nonpoint source concerns. Section 319 funded subgrants may be used to demonstrate innovative best management practices, support education and outreach programs, restore impaired waters, or protect waters from becoming impaired. In some cases, nonpoint sources for Section 319 purposes may differ from those outlined in the TMDL. For example, urban runoff regulated by an MS4 permit is considered a point source, but in some instances can be considered a nonpoint source for Section 319 purposes. More information regarding the Section 319 Nonpoint Source Implementation Program is available online at dnr.mo.gov/env/wpp/nps/index.html.

The Department's Soil and Water Conservation Program provides financial incentives to landowners to implement practices that help to prevent soil erosion and protect water quality. The program offers cost-share programs through its county conservation districts. Landowners can receive up to 75 percent reimbursement of the estimated cost of a practice through the program. The primary funding for cost-share practices from the Soil and Water Conservation Program comes from the one-tenth-of-one percent parks, soils and waters sales tax. More information regarding the Soil and Water Conservation Program and cost-share practices is available online at dnr.mo.gov/env/swcp/service/swcp_cs.htm.

In addition to these state sources of funding, federal assistance, public bonds and private financing may also be sources of available funding. The EPA maintains the Catalog of Federal Funding Sources for Watershed Protection, which is a searchable database of financial assistance

sources. The link to this online catalog as well as other federal funding sources is provided in Table 7.

Table 7. Online resources for potential funding sources

Name & URL	Description
Catalog of Federal Funding Sources for Watershed Protection https://ofmpub.epa.gov/apex/watershedfunding/f?p=fedfund:1	Searchable data of financial assistance sources for watershed protection
Nonpoint Source – Related Funding Opportunities http://water.epa.gov/polwaste/nps/funding.cfm	List of federal websites with information regarding funding opportunities
Water: Grants & Funding http://water.epa.gov/grants_funding/	EPA website providing information about available grants
Watershed Funding http://water.epa.gov/aboutow/owow/funding.cfm	Funding resources and tools from EPA
Environmental Education Grants http://www2.epa.gov/education/environmental-education-ee-grants	Financial support for environmental education projects
Targeted Watershed Grants Program http://water.epa.gov/grants_funding/twg/initiative_index.cfm	EPA grant to increase citizen stewardship of urban waterways
Environmental Justice Grants http://www3.epa.gov/environmentaljustice/grants/	Grant resources for Environmental Justice communities
Center for Environmental Finance http://www2.epa.gov/envirofinance	Provides direction and leadership for developing innovative financing methods
Grants.gov http://www.grants.gov	A common website for federal agencies to post funding opportunities

8. Measurable Goals, Timeline and Milestones

TMDL implementation uses an adaptive management process that makes progress toward achieving water quality goals while using any new information to reduce uncertainty and adjust implementation activities. Timelines and interim milestones for reaching this goal will vary depending upon the means of implementation, as well as the strategies used to address individual point or nonpoint sources. As part of the iterative and adaptive approach, timelines may be adjusted as additional information becomes available and implementation strategies are refined. For this reason, progress toward meeting water quality standards in the Fee Fee Creek (new) watershed is expected to be a long-term process and partially a continuation of current, ongoing or legally required activities, as well as any voluntary measures that may be planned or in place. Many of the necessary implementation activities will be the result of projects completed to meet the Metropolitan St. Louis Sewer District's consent decree and long-term control plan. The schedules established by these legal requirements will act as the primary timeline for TMDL implementation. Additional goals and milestones established in stormwater management plans for meeting MS4 permit requirements and those included in the nonpoint source watershed management plan should also be considered.

The consent decree also requires the elimination of all constructed sanitary sewer overflows in the Metropolitan St. Louis Sewer District's service area and provides a specific timeline for such

eliminations. In accordance with the consent decree, constructed sanitary sewer overflows will be scheduled for elimination by no later than 2033 with 85 percent of the overflow outfalls to be eliminated by 2023. The order of the eliminations will be based on the potential for human health and environmental risks, frequency of overflow, estimated volumes, and technical engineering judgment. A schedule for the elimination of all constructed sanitary sewer overflows in the Fee Fee Creek (new) watershed is presented in Table 8. A map showing the locations of constructed sanitary sewer overflows in the watershed can be found in Figure 6 of the TMDL document.

Table 8. Elimination dates of constructed sanitary sewer overflows

Name	Street No.	Street Name	Removal Date ¹²
BP-067	3186	Bristol Hall	N/A*
BP-068	2410	Bruno	2014
BP-069	1217	Crested View Drive	2023
BP-071	2	Fee Fee Road	N/A*
BP-072	165	Forest Brook Lane	2007
BP-073	166	Forest Brook Lane	2007
BP-074	113	Willow Brook Lane	N/A*
BP-075	67	Graeler	2005
BP-076	26	Gandy Drive	2016
BP-077	1	Harbor Circle	2003
BP-078	11623	Holy Springs	2023
BP-079	1032	Leisure Lane	N/A*
BP-080	2466	Majorlee	2023
BP-081	10964	Margate Hall Drive	N/A*
BP-082	10687	Midland Boulevard	2002
BP-083	107	Midland Boulevard	2015
BP-084	10808	Midland Boulevard	N/A*
BP-085	1301	Thames Court	2007
BP-086	11220	Triste Drive	2018
BP-087	11749	Westport Crossing	2023
BP-088	12479	Roth Hill	2010
BP-491	11050	Galaxy Court	2014
BP-511	N/A	Alan Shepard WWSR Lift Station	2016
BP-537	2667	Adie	2013
BP-540	121	Brookside	2007
BP-549	2008	Kratky Road	1999
BP-642	10908	Midland	2014
*Structure eliminated, no removal date provided			

MS4 stormwater management plans available at the time of this writing were developed prior to the approval of the Fee Fee Creek (new) *E. coli* TMDL. Following TMDL approval, it is expected that these stormwater plans will be revised as appropriate to incorporate the goals of both the TMDL and this implementation plan. Both the Metropolitan St. Louis Sewer District and the Department of Transportation have developed stormwater management plans that are

¹² The removal date indicates the date after which EPA can assess penalties.

available online. The plans are available on the respective organizations' websites at stlmsd.com/what-we-do/stormwater-management/phase-ii-stormwater-management-plan and modot.org/stormwater/. A detailed schedule pertaining to BMP implementation, illicit discharge detection, education, construction site runoff control, post-construction stormwater management, and pollution prevention is given in the Metropolitan St. Louis Sewer District's plan.¹³ The Department of Transportation plan is written to cover activities statewide, so it is more general in nature and does not contain a detailed schedule. However, it does note specific measurable goals associated with the implementation of various BMPs.

9. Conclusion

The purpose of this TMDL implementation plan is to serve as a guide to Department staff, Soil and Water Conservation districts, local governments, permitted entities, watershed managers, and citizen groups for reducing existing bacteria loads in order to meet the loading targets established in the Fee Fee Creek (new) *E. coli* TMDL. The ultimate goal is to restore Fee Fee Creek (new) to conditions that meet water quality standards using an adaptive implementation approach that makes progress toward achieving water quality goals while using new data and information to reduce uncertainty and adjust implementation activities. Implementation efforts are expected to be long-term, occurring over a number of years, but also within the schedules established in stormwater management plans, Section 319 watershed-based plans, state operating permits, and the Metropolitan St. Louis Sewer District's consent decree. Success in achieving water quality standards will be determined by the Department through biennial assessments of water quality compliance as required by Sections 305(b) and 303(d) of the federal Clean Water Act.

An administrative record for the Fee Fee Creek (new) *E. coli* TMDL has been assembled and is on file with the Department. The administrative record includes this implementation strategies, the TMDL, and any studies, data and calculations on which the TMDL is based. This information is available upon request to the Department at dnr.mo.gov/sunshine-form.htm. Any request for information will be processed in accordance with Missouri's Sunshine Law (Chapter 610, RSMO) and the Department's administrative policies and procedures governing Sunshine Law requests. For more information about open record/Sunshine requests, please consult the Department's website at dnr.mo.gov/sunshinerequests.htm.

This implementation plan is scheduled for a 45-day public notice and comment period in conjunction with the comment period for the Fee Fee Creek (new) *E. coli* TMDL. Any comments received and the Department's responses to those comments are maintained on file with the Department and are posted online at <https://dnr.mo.gov/env/wpp/tmdl/1704-fee-fee-creek-record.htm>. The Department maintains an email distribution list via GovDelivery.com for notifying subscribers regarding significant TMDL updates or activities. Those interested in subscribing to these TMDL updates may do so by submitting their email address at public.govdelivery.com/accounts/MODNR/subscriber/new?topic_id=MODNR_177.

¹³ See Chapter 11 of the stormwater management plan.

10. References

Brown, E., Caraco, D. and R. Pitt. 2004. Illicit Discharge Detection and Elimination a Guidance Manual for Program Development and Technical Assessments. EPA X-82907801-0

EPA (U.S. Environmental Protection Agency). 1997. Volunteer Stream Monitoring: A Methods Manual. EPA 841-B-97-003

EPA (U.S. Environmental Protection Agency). 2015. St. Louis Clean Water Act Settlement Webpage. [Online WWW] Available URL: <http://www2.epa.gov/enforcement/st-louis-clean-water-act-settlement> [Accessed Nov. 17, 2015].

MSD (Metropolitan St. Louis Sewer District). 2014. Sanitary Sewer Overflow Control Master Plan Revised – Aug. 29, 2014.

Appendix A

Nine Key Elements Critical to a Watershed Management Plan

- a. An identification of the causes and sources or groups of similar sources that will need to be controlled to achieve the load reductions estimated in this watershed-based plan (and to achieve any other watershed goals identified in the watershed-based plan, as discussed in item (b) immediately below. Sources that need to be controlled should be identified at the significant subcategory level with estimates of the extent to which they are present in the watershed (e.g., X number of dairy cattle feedlots needing upgrading, including a rough estimate of the number of cattle per facility; Y acres of row crops needing improved nutrient management or sediment control; or Z linear miles of eroded streambank needing remediation).
- b. An estimate of the load reductions expected for the management measures described under paragraph (c) below (recognizing the natural variability and the difficulty in precisely predicting the performance of management measures over time). Estimates should be provided at the same level as in item (a) above (e.g., the total load reduction expected for dairy cattle feedlots; row crops; or eroded streambanks).
- c. A description of the NPS management measures that will need to be implemented to achieve the load reductions estimated under paragraph (b) above (as well as to achieve other watershed goals identified in this watershed-based plan), and an identification (using a map or a description) of the critical areas in which those measures will be needed to implement this plan.
- d. An estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon, to implement this plan. As sources of funding, States should consider the use of their Section 319 programs, State Revolving Funds, USDA's Environmental Quality Incentives Program and Conservation Reserve Program, and other relevant Federal, State, local and private funds that may be available to assist in implementing this plan.
- e. An information/education component that will be used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the NPS management measures that will be implemented.
- f. A schedule for implementing the NPS management measures identified in this plan that is reasonably expeditious.
- g. A description of interim, measurable milestones for determining whether NPS management measures or other control actions are being implemented.
- h. A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made towards attaining water quality standards and, if not, the criteria for determining whether this watershed-based plan needs to be revised or, if a NPS TMDL has been established, whether the NPS TMDL needs to be revised.
- i. A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under item (h) immediately above.

Appendix B

Fee Fee Creek (new) Map of Highly Responsive (HRA) to BMP Implementation

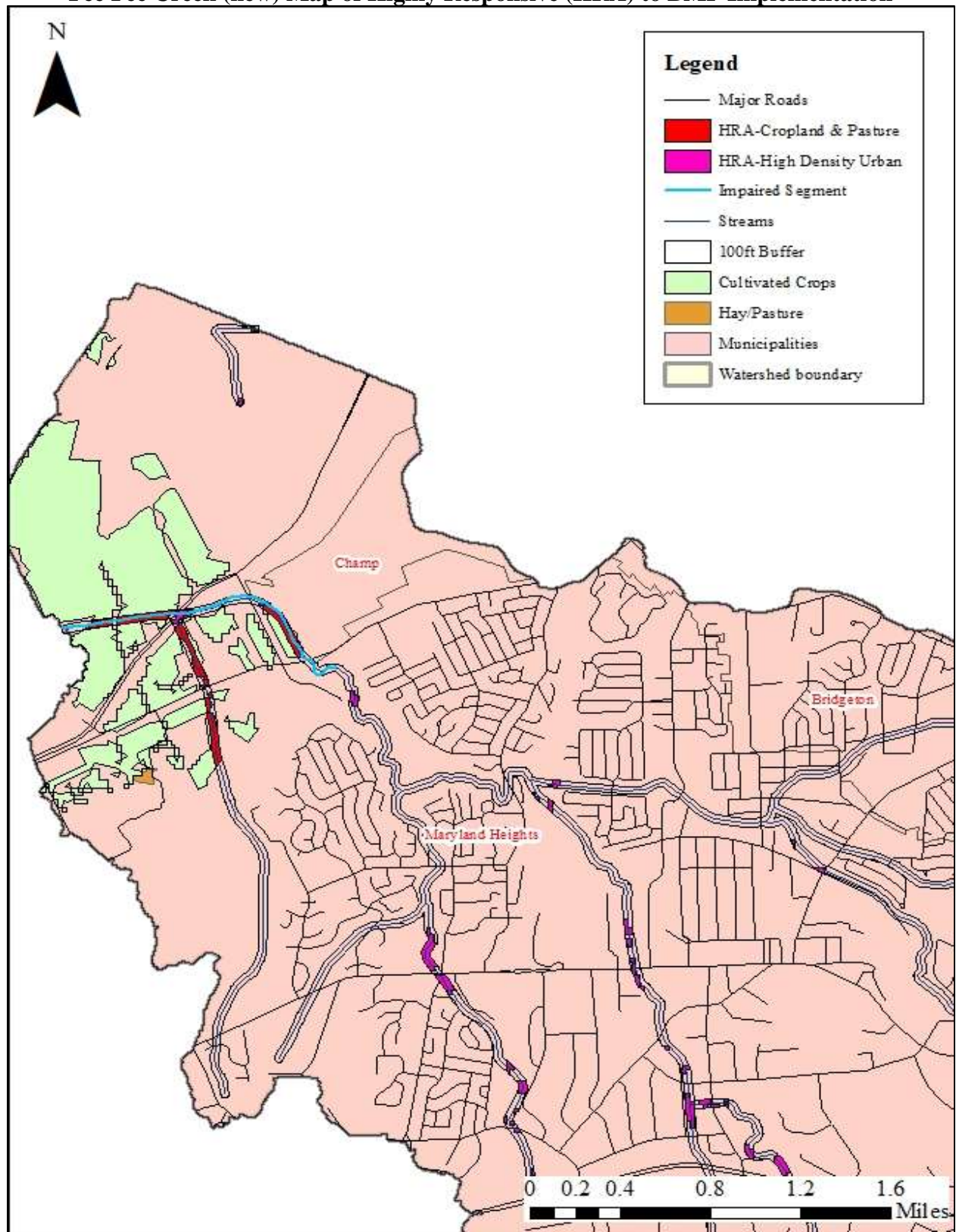


Figure A.1. Northern portion the Fee Fee Creek (new) watershed HRA map.

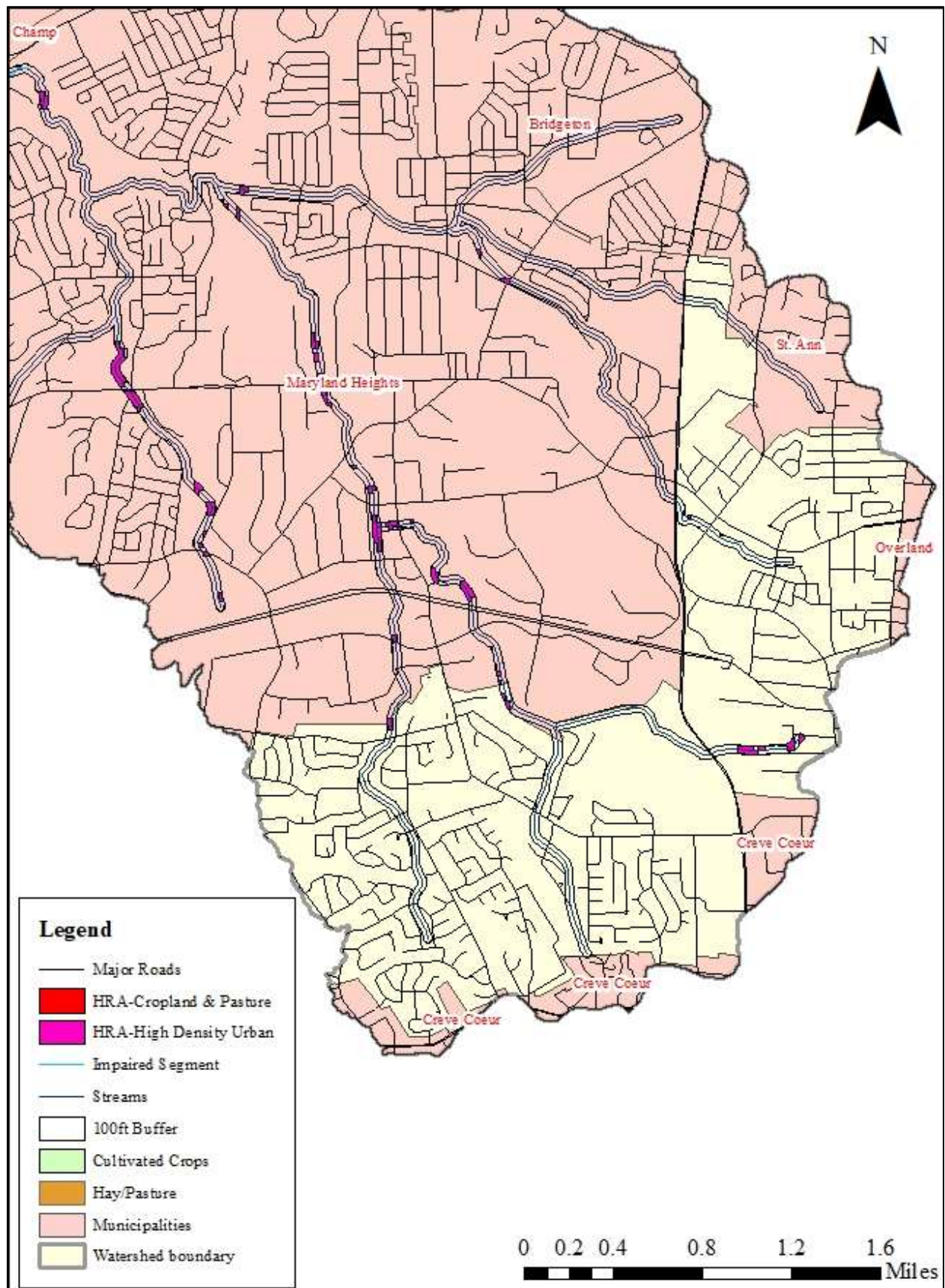


Figure A.2. Southern portion the Fee Fee Creek (new) watershed HRA map.